Structural properties of pulsed laser deposited zinc oxide thin films annealed at various temperatures

Abstract

Zinc oxide (ZnO) thin films were prepared by pulsed laser deposition (PLD) technique using XeCl excimer laser with a wavelength of 308 nm at room temperature on quartz and single crystal silicon (100) substrates. The oxygen gas pressure was set at 6 torr during the deposition. The deposited films were post-heat treated (HT) in air at different annealing temperatures (ATs) for 30 min. The X-ray diffraction (XRD), optical and electrical properties were measured to study the properties of the films as a function of AT. XRD analysis showed that the strength of (002) peak increases and full width at the half maximum (FWHM) value decreases as the AT increases from 200 to 600°C. The films HT at higher AT of ~600°C showed dominant c axis oriented hexagonal wurtize crystal structure. The films HT at 600°C exhibit high average transmittance of ~85% in the visible region and very sharp absorption edge at 376 nm with energy band gap of ~3·46 eV. Electrical measurement indicates that the resistivity of films decreases with the AT up to 600°C, after which there is an increase at higher AT. The complex of hydrogen defect and oxygen vacancy in the ZnO films may be the reason for low conductivity in undoped ZnO films.